

Equation

12. For each of the following identify the function that operates on the given input to produce the given output.



a. $f: x \rightarrow 5x$ Linear function $f(x) = 5x$

b. $g: \begin{pmatrix} 9 \\ 49 \\ 4 \end{pmatrix} \rightarrow \begin{pmatrix} 3 \\ 7 \\ 2 \end{pmatrix}$ Square Root function $g(x) = \sqrt{x}$

independent variable x dependent variable y

f. $k: \begin{pmatrix} -2 \\ 0 \\ 2 \\ 3 \\ 4 \end{pmatrix} \rightarrow \begin{pmatrix} 18 \\ 12 \\ 6 \\ 3 \\ 0 \end{pmatrix}$ Linear function $k(x) = -3x + 12$

c. $h: \begin{pmatrix} 0^\circ \\ 90^\circ \\ 180^\circ \end{pmatrix} \rightarrow \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$ Cosine function $h(x) = \cos x$

d. $i: \begin{pmatrix} 2 \\ 3 \\ 4 \\ 5 \end{pmatrix} \rightarrow \begin{pmatrix} 5 \\ 10 \\ 17 \\ 26 \end{pmatrix}$ Quadratic function. $i(x) = x^2 + 1$

1st diff. 2nd diff.

$5-2=3$ $10-5=5$ $17-10=7$ $26-17=9$

$7-5=2$ $9-7=2$

g. $l: \begin{pmatrix} -1 \\ 2 \\ 5 \\ 8 \\ 11 \end{pmatrix} \rightarrow \begin{pmatrix} 0 \\ 0 \\ -54 \\ -162 \\ -324 \end{pmatrix}$ Quadratic $l(x) = -3(x+1)(x-2)$

2 zeros

$y = a(x-r)(x-s)$

$y = a(x+1)(x-2)$

$-54 = a(5+1)(5-2)$

$-54 = 18a$

$-3 = a$

$\therefore y = -3(x+1)(x-2)$

e. $j: \begin{pmatrix} 0 \\ 4 \\ 8 \\ 12 \\ 16 \end{pmatrix} \rightarrow \begin{pmatrix} 1024 \\ 128 \\ 16 \\ 2 \\ 0.25 \end{pmatrix}$ Exponential function $j(x) = 1024\left(\frac{1}{8}\right)^x$

$1024 \cdot \frac{1}{8} = 128$

$128 \cdot \frac{1}{8} = 16$

$16 \cdot \frac{1}{8} = 2$

$2 \cdot \frac{1}{8} = 0.25$



13. Review some mathematical symbols to be used in this course

$\rightarrow$ "approaching"

$\{ \}$ set of

$\in$ element of

$\mathbb{R}$ Real number (decimals, negatives, positives, fractions, zero)

$\mathbb{I}$ or $\mathbb{Z}$ integers

$<$ less than

$\leq$ less and equal than

$>$ more/bigger/greater than

$\geq$ bigger and equal than

$\neq$ not equal/cannot be

$|$ "such that" $\rightarrow$ conditions

$\therefore$ because

$\because$ since

Functions vs. Non-Functions



1. What characterizes a relationship that is a function, and what may cause it to be a non function?

Functions have only one output (y) for every input (x) ($1x \neq 2ys$)
 ↳ Graph passes the Vertical Line Test

Non-function

↳ There are 2 or more outputs for a single input
 ↳ Graph does not pass the Vertical Line Test



2. Identify if each of the following is a function or not.

a. $\{(-3,5), (2,8), (-3,9), (0,-4)\}$

Not a function

- b. The input is button pressed on a vending machine and the output is the item that you get.

Yes

c. $x^2 + y = 5$

$y = -x^2 + 5$ Quadratic

Yes

d. $x + y^2 = 5$

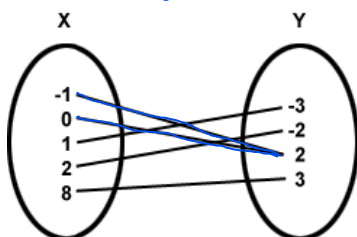
$y = \pm \sqrt{-x+5}$
 Not a function

e.

x	y
0	1
3	-5
6	1

Yes

f. Mapping Diagram



Yes



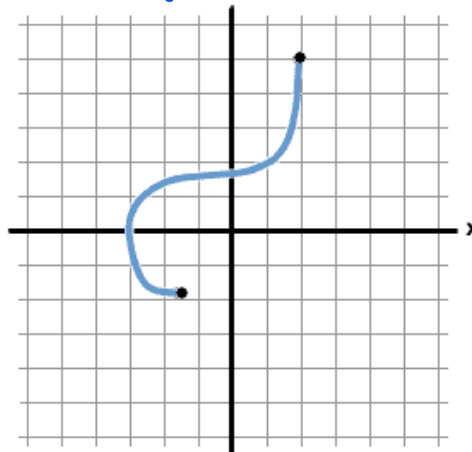
g. $\{(-1,4), (0,7), (5,-2), (10,7)\}$

Function

- h. The input is the postal code and the output is a person's address.

Function

- i. $y = x$ Vertical Line test
 is y a function of x?
 $x \rightarrow$ input $y \rightarrow$ output



- j. $x = y$ Horizontal line Test
 is x a function of y for the above?



3. What is the **domain** and **range** of a relation?

Domain (x) = all defined values of independent variable

Range (y) = all outputs y from the given domain.

$x \in \mathbb{R}$
 ex: $D = \{x \in \mathbb{R} \mid x \neq 0\}$
 $R = \{y \in \mathbb{R} \mid y < 2\}$



4. State if the following are functions or not and then state the domain and range.

a. You are investigating the **average height** of a grade 9 student in Ajax.
 independent variable

Function

$D = \{\text{all grade 9 student in Ajax}\}$
 $R = \{\text{heights}\}$

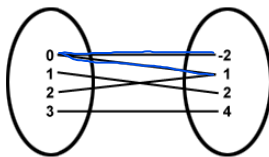
b. $y = \sqrt{3-6x}$

Square Root.

$0 = \sqrt{3-6x}$
 $0 = 3-6x$
 $6x = 3$
 $x = \frac{1}{2}$
 $x < \frac{1}{2}$
 $x > \frac{1}{2}$

$D = \{x \in \mathbb{R} \mid x \leq \frac{1}{2}\}$
 $R = \{y \in \mathbb{R} \mid y \geq 0\}$
 $y = \sqrt{3-6(\frac{1}{2})}$
 $y = 0$

c.

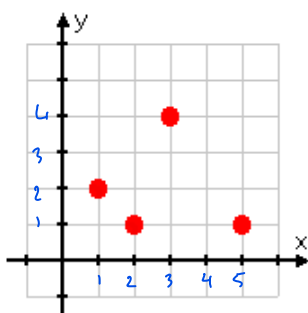


Not function

because zero has 2 outputs: 1, -2

$D = \{x = 0, 1, 2, 3\}$
 $R = \{y = -2, 1, 2, 4\}$

d.

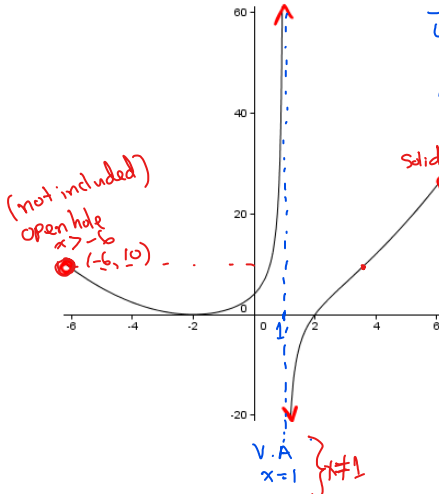


Function

because passes the vertical line test

$D = \{x = 1, 2, 3, 5\}$
 $R = \{y = 1, 2, 4\}$

e.



Function

↳ it passes the Vertical Line test.

$D = \{x \in \mathbb{R} \mid -6 < x < 6, x \neq 1\}$
 $R = \{y \in \mathbb{R}\}$

h. $y = \frac{1}{4-2x}$

Rational function

$y = \frac{1}{-2(x-2)}$
 $a=2$
 move 2 units right
 $\Rightarrow$ Domain change

$D = \{x \in \mathbb{R} \mid x \neq 2\}$
 $R = \{y \in \mathbb{R} \mid y \neq 0\}$

i. $x^2 + y^2 = 25$

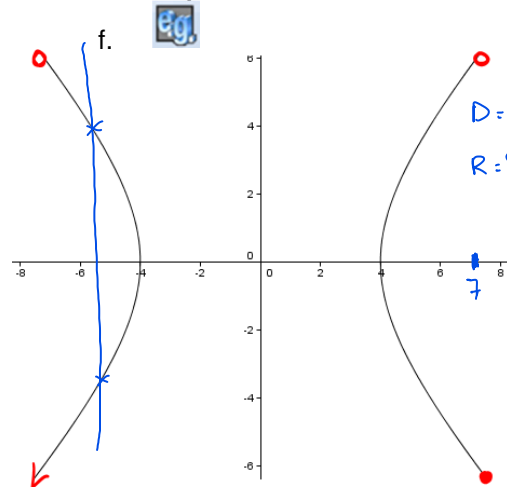
$x^2 + y^2 = r^2$



Circle with $r = 5$

Not a function

$D = \{x \in \mathbb{R} \mid -5 \leq x \leq 5\}$
 $R = \{y \in \mathbb{R} \mid -5 \leq y \leq 5\}$



Not a function
 ↳ not pass VLT

$D = \{x \in \mathbb{R} \mid x \geq -4 \text{ and } x \leq 7\}$
 $R = \{y \in \mathbb{R} \mid y < 8\}$

g. $y = -2x^2 + 8x - 1$

Quadratic function
 $a > 0$
 $a < 0$

$(-\frac{b}{2a})^2 = 4$

$y = -2(x^2 - 4x) - 1$
 $y = -2(x^2 - 4x + 4 - 4) - 1$
 $y = -2(x^2 - 4x + 4) + 8 - 1$
 $y = -2(x-2)^2 + 7$

$D = \{x \in \mathbb{R}\}$

$R = \{y \in \mathbb{R} \mid y \leq 7\}$

$R = \{y \in \mathbb{R} \mid y \leq k\}$

Find vertex from standard:

① complete the square
 ↳ vertex form

② factored
 ↳ take average of zeros
 $y = a(x-r_1)(x-r_2)$
 $\frac{r_1+r_2}{2} \Rightarrow h$



5. What is function notation? What are the benefits and disadvantages of using the function notation?

output
 $f(x)$
 name of function
 independent variable (input)

$f(x) = y$

$f(1) =$
 $\neq$
 $x=1$

$x=1 \quad y= \dots$



6. Find the following for the functions $f(x) = 2x^4 - 3x^2$, $h(a) = \sqrt{a-5}$, $g(k) = \frac{6k}{k+1}$

a. $f(2) = 2(2)^4 - 3(2)^2$
 $= 2(16) - 3(4)$
 $= 32 - 12$
 $= 20$

b. $h(69) = \sqrt{69-5}$
 $= \sqrt{64}$
 $= 8$

c. $f(\sqrt{5}) - h(30)$
 $= [2(\sqrt{5})^4 - 3(\sqrt{5})^2] - [\sqrt{30-5}]$
 $= (50 - 15) - 5$
 $= 35 - 5$
 $= 30$

d. $f(-3) + 4g(3)$
 $= [2(-3)^4 - 3(3)^2] + 4\left(\frac{6(3)}{3+1}\right)$
 $= [2(81) - 27] + 18$
 $= 162 - 27 + 18$
 $= 162 - 9$
 $= 153$

e. $2g\left(\frac{1}{2}\right)f(-1) = -4$
 $= 2\left(\frac{6\left(\frac{1}{2}\right)}{\frac{1}{2}+1}\right)\left(2(-1)^4 - 3(-1)^2\right)$
 $= 2(2)(2-3)$
 $= 4(-1)$
 $= -4$

Homework: Pg. 11 # 1-4

f. $g(3)^{h(6)} = \frac{9}{2}$
 $\left(\frac{6(3)}{3+1}\right)^{\sqrt{6-5}}$
 $= \left(\frac{18}{4}\right)^1$
 $= \frac{9}{2}$

7. Write down the formula, in function notation for the perimeter of a rectangle, considering perimeter as input and length as output.

8. Write the area of a circle as a function of its perimeter.

9. Write the area of a circle as a function of its radius

10. Write the perimeter of a circle as a function of its radius

11. Write down the formula, in function notation for the area of the triangle, considering area as input and height as output.